



INSTRUCTIONS

Universal Exchange Component Board

For Types VR-1™, ML32, And TMLT32
Step Voltage Regulators with
Automatic Static Controls

MP MASTER



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INTRODUCTION

There are several Automatic Static Control component boards manufactured for Type VR-1™, ML 32, and TMLT 32 step voltage regulators. When a replacement board is needed, the Universal Exchange component board (Fig. 1) is used. This board is 5½ inch × 8½ inch in size and

resembles the more recent production of boards on original equipment. This universal board does, however, differ from these and other types. It has an electronic subassembly mounted on and connected to a main static control circuit component board. This supplemental assembly contains a control circuit which permits the use of the exchange board universally. Refer to Figs. 2 and 3.

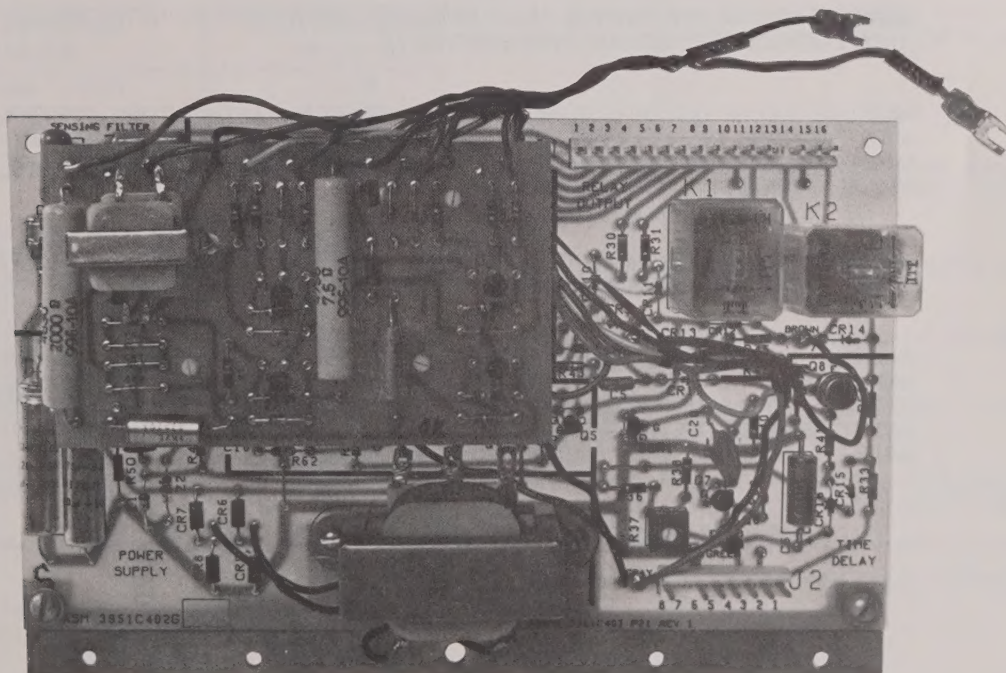


Fig. 1. Universal exchange component board (Shown without adapter harness that is normally supplied)

SAFETY HAZARD INFORMATION

GENERAL

The text of this instruction manual includes information concerning hazards to safety which are common to all regulators. This safety hazard information is offered for guidance when installing, operating and maintaining this equipment. Warning and caution statements are interspersed with the descriptive matter to aid in preventing damage to the equipment and to advise of possible hazards to personnel. When reading this text, the meaning and content of these statements should be understood and followed carefully.

The equipment covered by these operating instructions should be operated and serviced only by competent technicians familiar with good safety practices, and these instructions are written for such personnel and are not intended as a substitute for adequate training and experience in safe procedures for this type of equipment.

WARNING: *SINCE TROUBLESHOOTING ENTAILS WORKING WITH ENERGIZED EQUIPMENT, CAUTION SHOULD BE TAKEN TO AVOID PERSONAL SHOCK.*

WARNING: *OPENING THE CONTROL PANEL TO INSPECT THE INTERIOR WHEN THE REGULATOR IS ENERGIZED EXPOSES ALL LIVE COMPONENTS.*

WARNING: *BEFORE DISCONNECTING ANY PLUG CONNECTOR BETWEEN THE CONTROL PANEL COMPONENT BOARD AND NN TERMINAL BOARD OR DISCONNECTING ANY CONNECTION TO THE NN TERMINAL BOARD, REMOVE THE CONTROL CABLE PLUG FROM THE BOTTOM OF THE POSITION INDICATOR HOUSING.*

WARNING: *TO PREVENT CONTROL CIRCUIT DAMAGE, THE POSITION INDICATOR PLUG MUST BE COMPLETELY ENGAGED AND THE SCREWS TIGHTENED.*

WARNING: *TO PROVIDE MAXIMUM PROTECTION TO THE OPERATOR MAKE SURE THE REGULATOR IS THOROUGHLY AND EFFECTIVELY GROUNDED. THE GROUNDING CONDUCTOR SIZE SHOULD BE IN ACCORDANCE WITH NEC REQUIREMENTS TO ELIMINATE THE POSSIBILITY OF BURNING OFF THE GROUND CONDUCTOR IN CASE OF A LINE GROUND. DO NOT REMOVE THE GROUND WHILE THE REGULATOR IS ENERGIZED.*

INSTALLATION

WARNING: BEFORE REPLACING THE OLD COMPONENT BOARD, IT IS MANDATORY TO DISCONNECT THE CONTROL PLUG (P2) BETWEEN THE POSITION INDICATOR HOUSING AND THE CONTROL CABINET.

The component board which is to be replaced by the Universal Exchange board can be removed as follows:

Remove the five nuts (10½ inch x 8½ inch board) or three nuts (5½ inch x 8½ inch board), disconnect the two plugs in the lower right hand corner of the control cabinet, and the three terminals on the top terminal board.

Installations are classed as General, Particular, and Other.

GENERAL

As a general rule, when replacing component boards with the Universal Exchange board, the leads extending from the top harness must be connected to the Static Control NN terminal board as described in the following table.

UNIVERSAL EXCHANGE BOARD LEADS	STATIC CONTROL NN BOARD
Black (see Notes 1 and 2)	NN26
Red/black	NN30
Red	NN27
Green	NN28

NOTE: If a universal exchange board with J1 and J2 (indicating the new design) is to be changed out with another new design, only the J1 and J2 connectors need to be disconnected. Other changes have already been made.

PARTICULAR

Installations that do not conform to the table are listed under the following notations.

Note 1

For Type TMLT 32 regulators with fan control using the 10½ × 8½ size component board, modify the connections as follows:

1. Take XA* connector plug and with a small screwdriver, remove the pronged terminal wire (XA-11). The wire connects to the AA terminal board at AA-7. It is used in the fan control circuit.

2. Insert this pronged terminal wire into XA-11 (J3-11) of the new component board.

3. Disconnect the lead from the old component board (XEA11 to AA6). Disconnect the yellow lead (ATJ2-6) on the bottom row of the new component board. Then connect this lead to terminal board AA, terminal six (6). The reconnected circuit will run from J3-8 (XA-8) to AA6.

4. Connect the leads from the new component board to the terminal board points as noted earlier.

5. Disable the supplemental board function by clipping out and disconnecting three diodes (CR1, CR3 and CR10) located on the supplemental component board. Refer to Fig. 4.

Note 2

For regulators with the First House Voltage Protector accessory provided, and the defective component board is **NOT** a Universal Exchange board, proceed as follows:

1. Disconnect and discard the black wire connector from BB-1 terminal board of the First House Protector to the NN26 terminal board of the Automatic Static Control.

2. Connect a new black wire from BB-1 to the Output Voltage Test terminal nearest the control panel hinge.

OTHER

There are types of regulators that do not require the supplemental component board assembly on the Universal Exchange component board. These are:

1. Type ML 32 regulators having serial numbers lower than D586000.

2. Type TMLT 32 regulators without fan control† and Type MLT 32 regulators.

3. Type ML 32 regulator controls with an external motor compensation transformer.

The supplemental board function should be disabled by clipping out and disconnecting three diodes (CR1, CR3 and CR10) and shorting out one resistor, R14.

Refer to the supplemental board, Fig. 4, for location of components.

CALIBRATION

After the component board has been identified and replaced with the Universal Exchange component board, it is necessary to calibrate the Automatic Static Control.

* Designations XA, XB and XC used on older connection diagrams are the same as J3, J4 and J5 used on more recent diagrams.

† For Type TMLT 32 regulators with fan control, see Note 1.

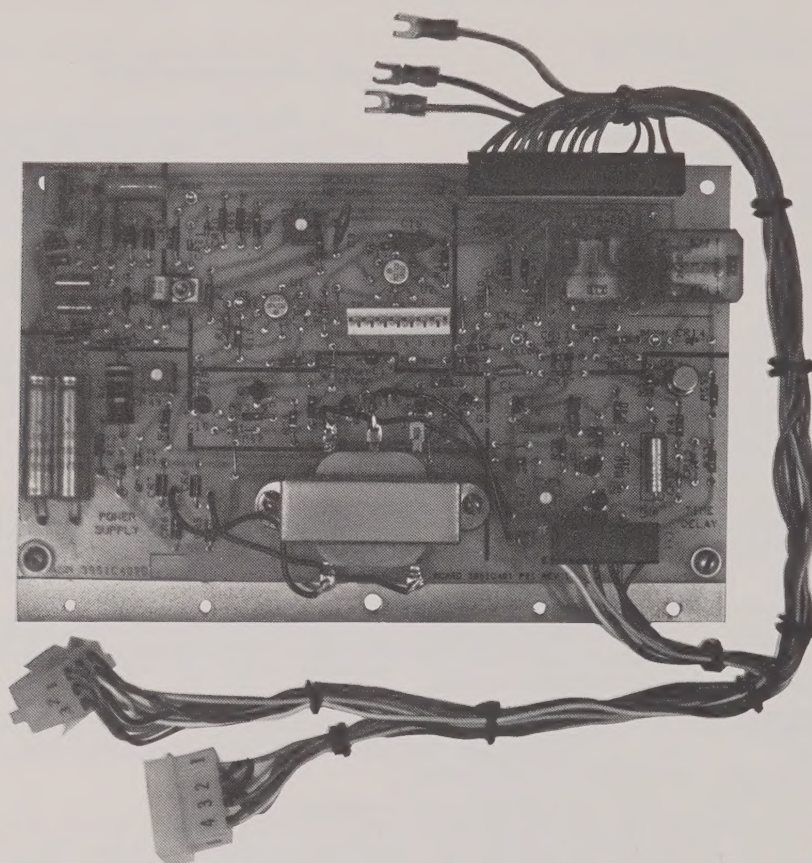


Fig. 2. Universal exchange board — main component board layout (Refer to Fig. 7 or 8 legend for device nomenclature) (supplemental component board location is shown in Fig. 1)

Before proceeding, however, refer to the regulator nameplate for the applicable instruction book number assigned to the step voltage regulator. Review in this instruction book sections concerning SAFETY HAZARD INFORMATION, OPERATION, GENERAL TEST PROCEDURES and TROUBLESHOOTING.

When calibrating the Automatic Static Control, use a high impedance meter.

PROCEDURE

1. Connect a calibrated voltmeter to the Output Voltage test terminals.
2. Turn the Line Drop Compensation knobs to zero or set the LDC on-off switch to OFF (if provided).
3. Turn the Control Switch to TEST. Set the Voltage Level adjust rheostat until both Band Edge Indicator lights are out.

4. Turn the Voltage Level Adjust rheostat knob towards lower voltage level: read the dial marking when the high light comes on: repeat this procedure, turning the Voltage Level Adjust rheostat towards higher voltage level until the Low Band Edge Indicator light comes on. Read the dial marking. The difference between these two readings is the bandwidth. If the bandwidth differs from the calibrated setting shown on the Bandwidth knob dial, it may be necessary to adjust the Bandwidth rheostat (R28) by removing the knob, loosening the mounting nut and rotating the rheostat to obtain correct indication.

5. With the bandwidth properly calibrated, check the accuracy of the voltage level calibration by comparing the readings of the Voltage Level rheostat dial settings with the readings recorded on a high impedance 150-volt calibrated voltmeter, connected to the Test terminals on the control panel. Be sure that the Test rheostat is in the AUTO position. If an error exists, adjust R49 on the main circuit board to calibrate at the 110-volt level. Recheck by turning the Voltage Level rheostat until the voltage level calibration is re-established. After R49 has been adjusted to calibrate the

desired point, increase the level setting to 130 volts and adjust R7 as required to correct the calibrations at this new setting. If R7 is changed appreciably, recheck the original calibrated point and readjust R49 as required to refine the adjustment. If it is not permissible to run the regulator over the wide range required for complete calibration, adjust R49 only to calibrate at the specific level desired.

6. Reset the Control Switch to AUTO. Allow the control to return the voltage level to normal.

7. It is not anticipated that the time delay will require recalibration but it may be checked as outlined in the applicable standard instruction book. If the error is excessive, resistor R37 assembled on the main circuit board may be adjusted to improve accuracy. Clockwise rotation of this resistor will increase the time delay.

8. Reset the Line Drop Compensation knobs to the required settings or turn on LDC if required. Control recalibration is now complete.

SUPPLEMENTAL CONTROL CIRCUIT BOARD

INTRODUCTION

This component board is an electronic subassembly mounted on the left hand corner of the Universal Exchange board. Refer to Fig. 3. The control action of the standard Static Control is unaffected by this Supplemental Control circuit until the step voltage regulator drive motor is energized.

Operational information concerning the Supplemental Control circuit is described here. Tables 1 and 2 (Voltage Measurement and Troubleshooting Charts) will aid if a malfunction occurs. When reviewing the operation and/or using the charts, refer to Figs. 4 through 8 which show the schematic diagram and component board layouts. The complete Automatic Static Control with the Supplemental Control circuit for Type VR-1 and ML 32 regulators is shown in Figs. 6, 7, and 8.

VOLTAGE MEASUREMENT AND TROUBLESHOOTING

INTRODUCTION

Tables 1 and 2 (Voltage Measurement and Troubleshooting Charts) are divided into two parts: one concerns troubleshooting the supplemental control component board control circuit (Table 2); the other applies to the main component board (Table 1).

WARNING: SINCE TROUBLESHOOTING ENTAILS WORKING WITH ENERGIZED EQUIPMENT, CAUTION SHOULD BE TAKEN TO AVOID PERSONAL SHOCK.

LOCATION OF MALFUNCTION

To determine which component board is malfunctioning, the following test will indicate, in most instances, the location of the fault.

Place a temporary wire connection across supplemental component board resistor R14. Normal operation of the control circuit should be observed, just as if the supplemental component board circuit were not supplied. If this is the case, the problem should be found in the supplemental control circuit. On the other hand, if the control circuit still malfunctions, R14 shorted, the problem most likely is to be found in the main component board control circuit.

Table 1 entitled the "Voltage Measurement Chart" and Table 2 entitled the "Troubleshooting Chart" concern the supplemental component board circuit. Refer to the instruction books GEH-4277 or GEH-4281 "STEP VOLTAGE REGULATORS — TYPE VR-1," GEH-4239 "STEP VOLTAGE REGULATORS — TYPE ML 32" and GEH-4278 "STEP VOLTAGE REGULATORS — TYPE TMLT 32" for information concerning troubleshooting of the main component board control circuit. These instruction books may be obtained, upon request, from your nearest General Electric Sales Office.

OPERATION

Refer to Figs. 4, 5, 6, 7, and 8. Note that the Supplemental Control circuit is designated as Unit 3. The motor current creates a voltage drop across 3R14. * This voltage is rectified, filtered and applied to the base of transistor 3Q4, turning 3Q4 ON. With 3Q4 ON, it is then possible for either 3Q1 or 3Q2 to turn ON. If relay K1 is energized, 3Q1 will turn ON. Remember that either K1 or K2 must be ON in order to have obtained motor current to start this sequence. When energized, transistor 3Q1 or 3Q2 provides a shunt to pull down the sensing amplifier voltage at point A5 or points 9 and 10 of the main component board around the sensing

*3R14 = Unit 3, Resistor 14

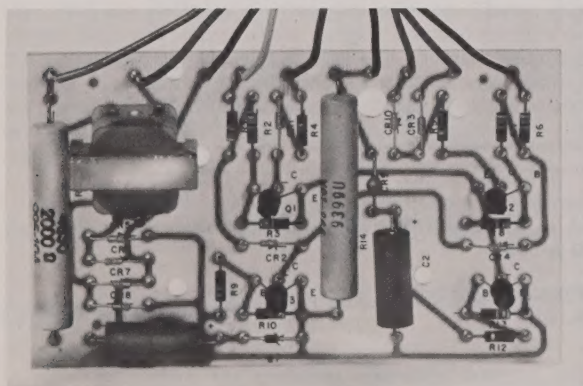
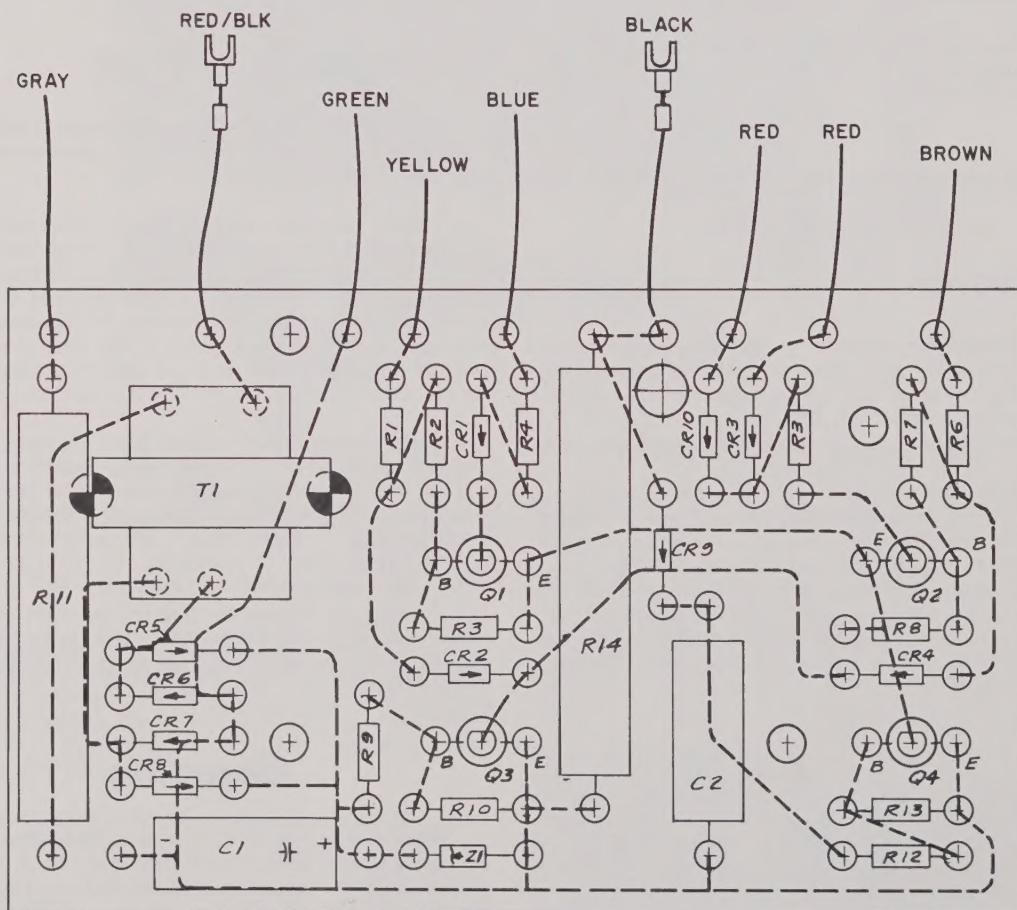


TABLE 1 VOLTAGE MEASUREMENT CHART

TEST POINT	AT REST	CONDITIONS	
		MOTOR RUNNING	AT TAP CHANGE
Across 3R14	0	3-4 Vac	—
Across 3C2	0	3.5-5 Vdc	—
Across 3C1	0	0	8 Vdc PULSE
Q1 Collector to Common*	6 Vdc	0.5 Vdc	6 Vdc
Q2 Collector to Common*	6 Vdc	0.5 Vdc	6 Vdc
Q3 Collector to Common*	—	10.0 Vdc	0 Vdc PULSE

*Common of Main Component Board. See Figs. 7 and 8.



NOTES:

1. MEASUREMENTS ARE MADE WITH A 10,000 OHMS/VOLT MULTIMETER
2. 3T1 WINDINGS, APPROXIMATELY 60 OHMS
3. COMMON IS THE GREEN LEAD
4. TO DISABLE SUPPLEMENTAL COMPONENT BOARD FUNCTION, CLIP OUT AND DISCONNECT DIODES CR1, CR3, AND CR10.

Fig. 4. Unit 3, supplemental component board — troubleshooting and voltage measurement layout

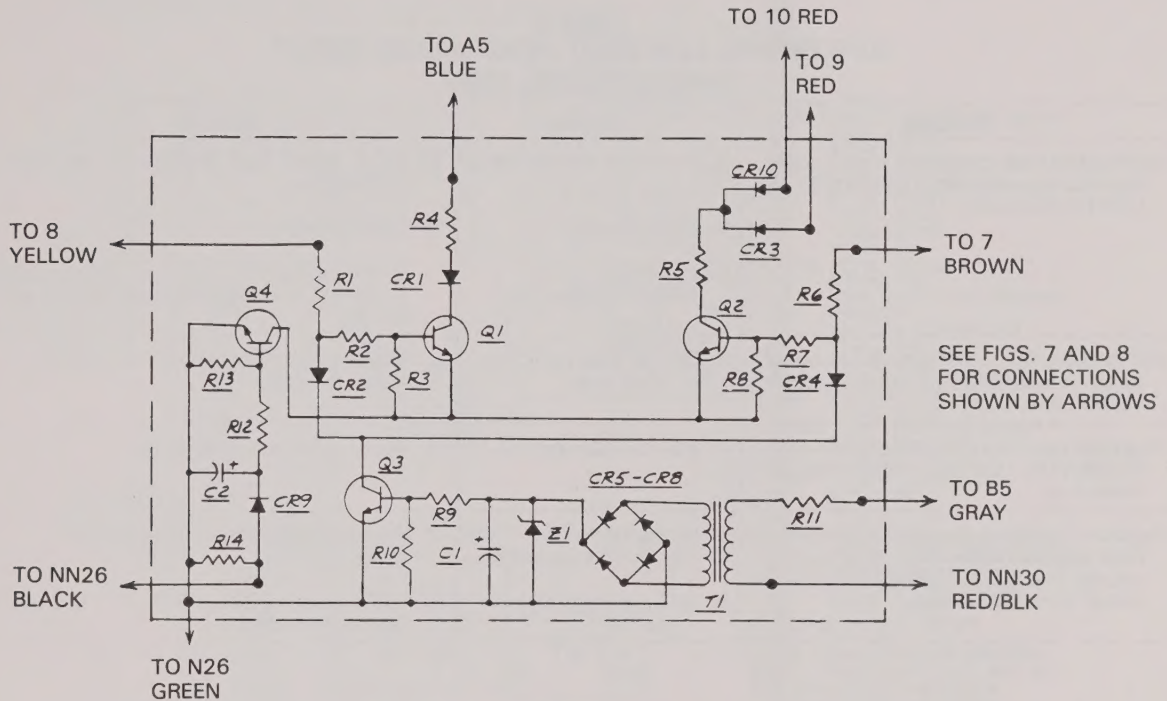


Fig. 5. Unit 3, supplemental component board schematic circuit

amplifier. This creates a highly unbalanced condition that could not be overcome by a transient line voltage swing. Therefore, the tap changer motor will continue to run in the same direction regardless of line voltage conditions.

As the tap change is made, the Operation Counter switch in the Position Indicator closes momentarily; this causes current to flow in the primary of 3T1. The rectified secondary current charges capacitor 3C1 to a peak voltage determined by the zener diode 3Z1. This voltage is used to turn 3Q3 ON for approximately 1.5 seconds. During this period, 3Q3 shunts aside the current supplied to 3Q1 or 3Q2, thereby turning 3Q1 or 3Q2 OFF and returning the sensing amplifiers to normal conditions. If the new existing line voltage condition satisfies the control, the control will be balanced, relay K1 or K2 will drop out and the system will come to rest.

If an additional tap change is required, the relay will not drop out and the motor will continue to operate.

CHECKING OPERATION

The procedure for checking operation follows. All switches, knobs and lamps are located on the Automatic Static Control panel. Refer to the standard instruction book.

1. The Automatic Static Control must be in a balanced condition.

2. With the Control Switch on TEST, move the Voltage Level Adjustment knob back and forth across the balance point. The Band Edge Indicator lamps should show normal operation. Return the Voltage Level Adjustment knob to the balance point. Move the Control Switch to AUTO.

3. Move the Voltage Level Adjustment knob several volts from the balance point to operate the mechanism in a RAISE direction. Allow the time delay to time out and the regulator motor to start driving the tap changer mechanism. Return the Voltage Level Adjustment knob to the balance voltage — the motor should continue to operate until the tap change is made.

4. Repeat the above procedure for checking operation in the LOWER direction.

RENEWAL AND SPARE PARTS

Orders for renewal or supply parts should be placed with the nearest Sales Office of the General Electric Com-

TABLE 2
SUPPLEMENTAL COMPONENT BOARD CONTROL CIRCUIT
TROUBLESHOOTING CHART

TROUBLE	CAUSE	REMEDY
SUPPLEMENTAL CONTROL circuit board function inoperative for both RAISE and LOWER directions.	a. 3Q4 does not turn on. b. 3Q3 shorted. c. Operation counter switch maladjusted.	a. 3R14, 3CR9, 3C2 and/or 3Q4 may need replacement. b. Replace 3Q3. c. With regulator at rest check voltage. 120 V ac should be present between NN 30 and NN 10.
SUPPLEMENTAL CONTROL circuit board function inoperative for either RAISE or LOWER directions.	a. 3Q1 or 3Q2 or 3CR1 or 3CR2 open.	a. Replace defective component as shown under CAUSE.
Regulator runs to a limit because the SUPPLEMENTAL CONTROL circuit does not rebalance.	a. 3Q1 or 3Q2 shorted.	a. Replace defective transistor.
Regulator oscillates between the maximum raise and maximum lower relay continuously. The SUPPLEMENTAL CONTROL circuit does not balance.	a. Operation counter switch S8 inoperative. b. 3Q3 does not turn on.	a. Check counter action. Replace S8 if necessary. b. 3T1 windings, 3R11, 3Z1, 3C1 and/or 3Q3 may be defective.

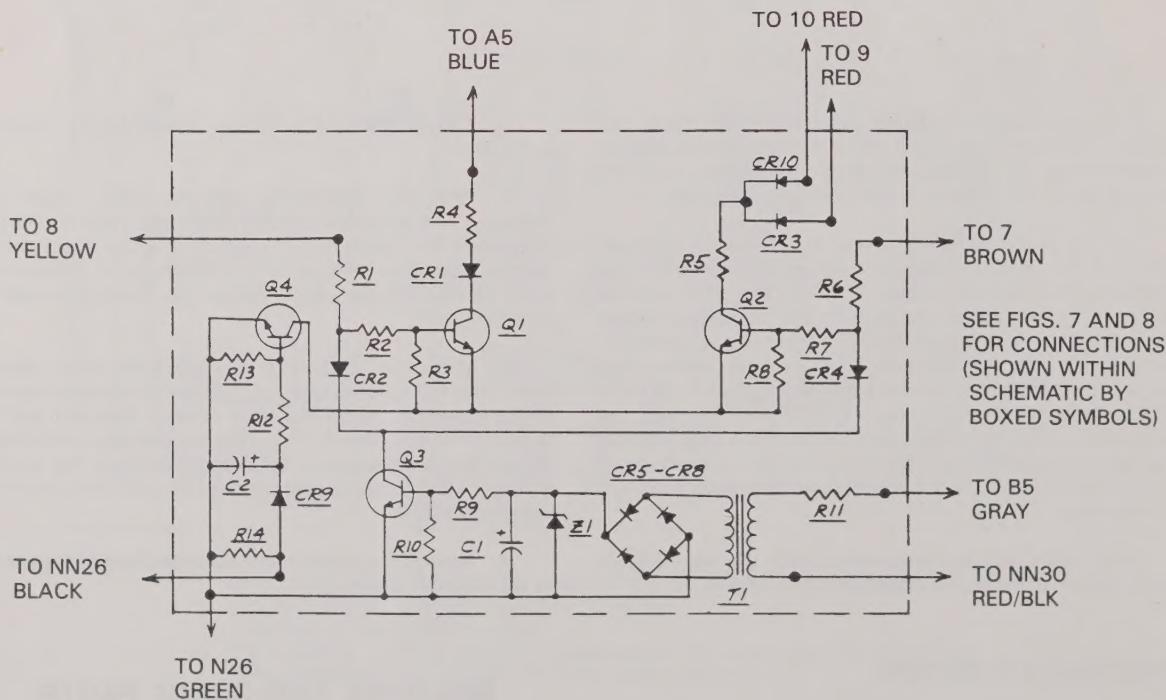


Fig. 6. Unit 3, universal exchange board supplemental component board schematic circuit

ELEMENTARY DIAGRAM FOR SOLID STATE TYPE LINE DROP COMPENSATION

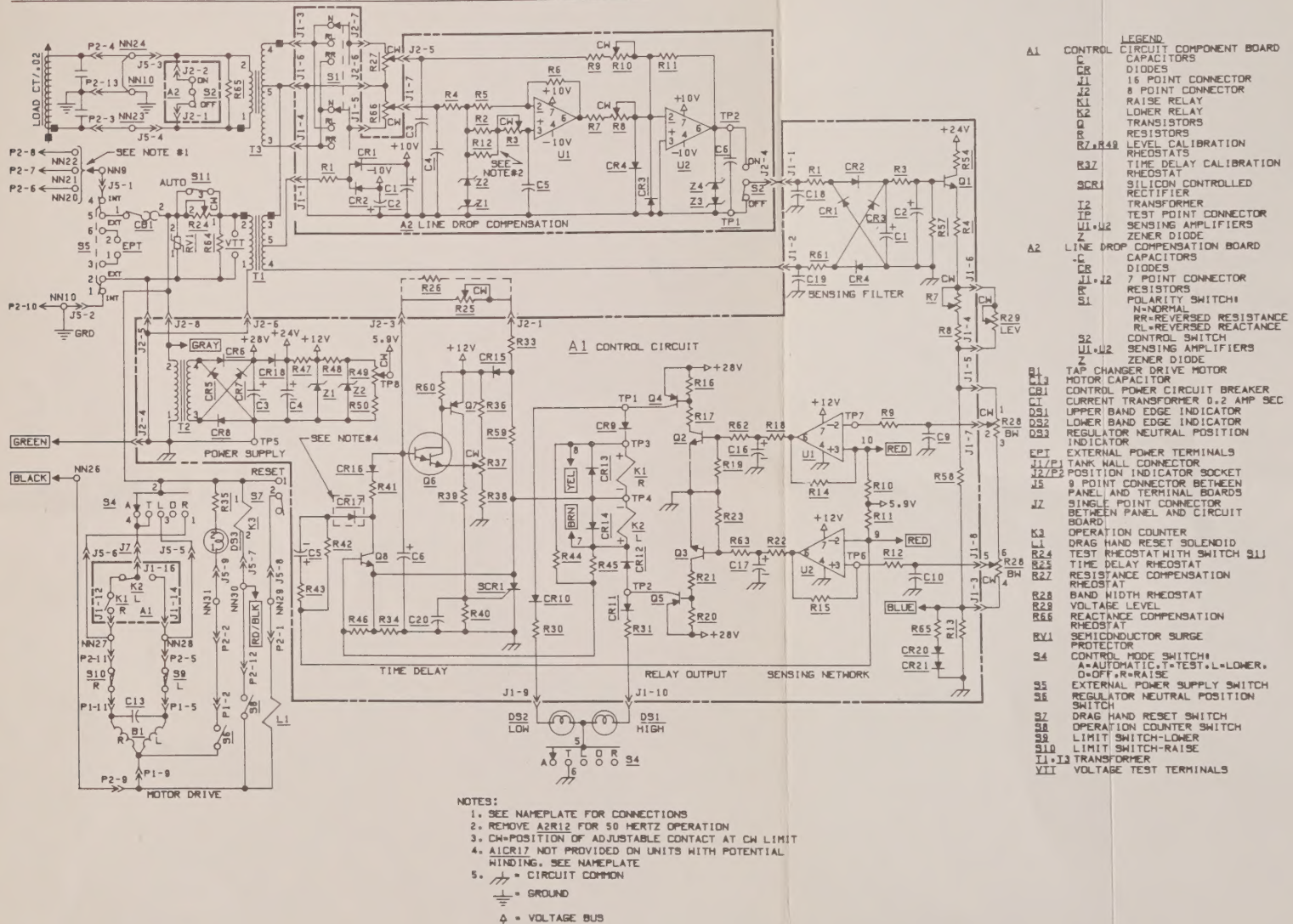


Fig. 7. Universal exchange board main component board schematic circuit (Solid state type line-drop compensation)

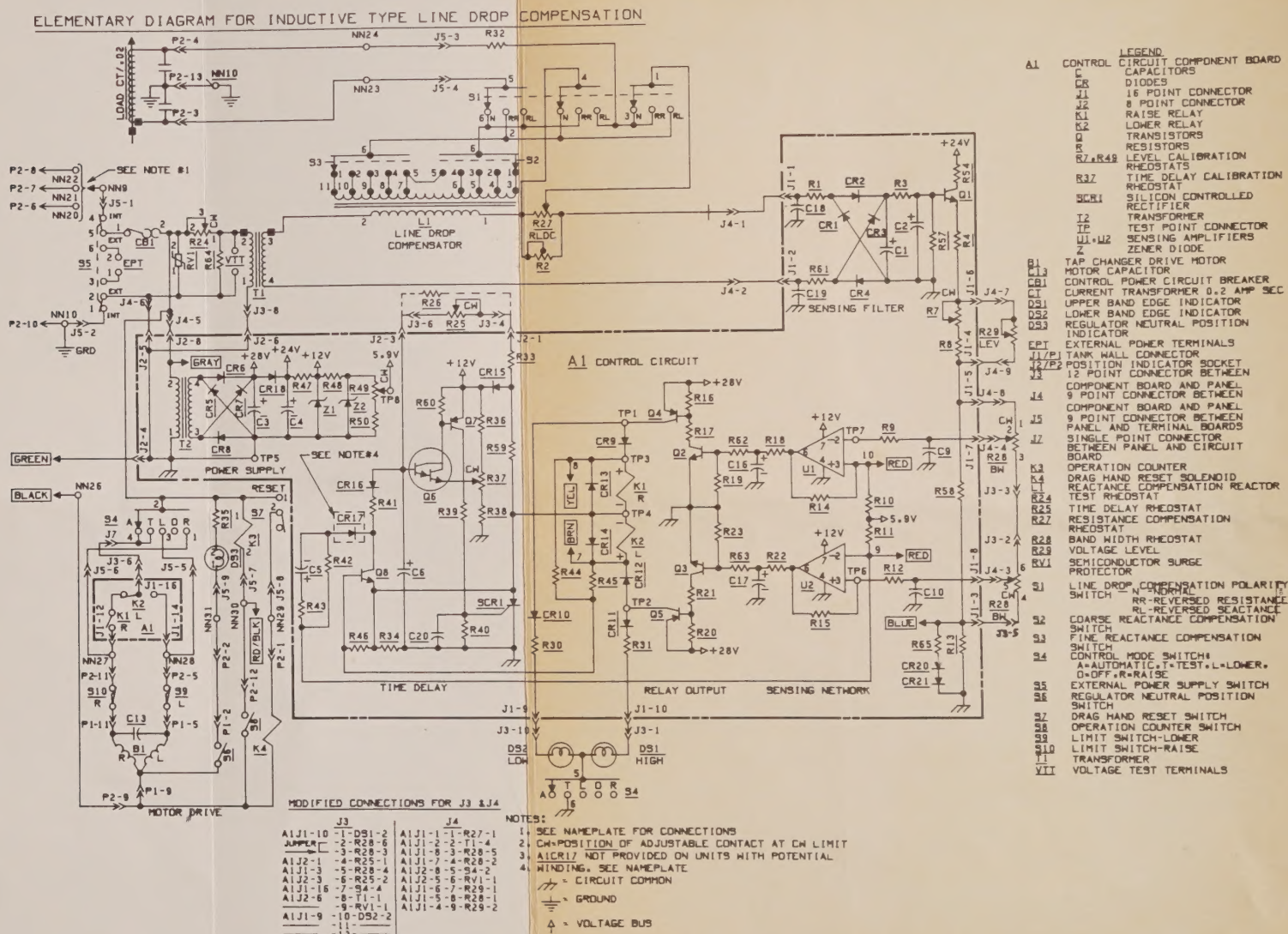


Fig. 8. Universal exchange board main component board schematic circuit (Inductive type line-drop compensation)

pany. Specify the serial number, the quantity required, description of the part and the catalog or drawing number of the part, whenever possible. Always specify the serial number appearing on the nameplate.

Any renewal parts supplied will be manufactured from the same or similar materials as those used originally. Successful operation of the renewal parts is contingent upon proper field assembly, the condition of the remaining parts, and a thorough drying cycle if moisture has entered the regulator.

SERVICE

If you need to repair, recondition or rebuild any electrical apparatus, a General Electric Service shop near you is available for work in the shop or on your premises. Latest factory methods and genuine General Electric Renewal Parts are used to maintain the original performance of your General Electric equipment. For full information about these services, contact the nearest General Electric Service Shop or Sales Office.

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